FIXED DENTURES. ALGORITHM OF PRODUCING

Minsk BSMU 2018

МИНИСТЕРСТВО ЗДРАВООХРАНЕНИЯ РЕСПУБЛИКИ БЕЛАРУСЬ
БЕЛОРУССКИЙ ГОСУДАРСТВЕННЫЙ МЕДИЦИНСКИЙ УНИВЕРСИТЕТ
КАФЕДРА ОРТОПЕДИЧЕСКОЙ СТОМАТОЛОГИИ

КЛИНИКО-ЛАБОРАТОРНЫЕ ЭТАПЫ ИЗГОТОВЛЕНИЯ НЕСЪЕМНЫХ ЗУБНЫХ ПРОТЕЗОВ

FIXED DENTURES. ALGORITHM OF PRODUCING

Учебно-методическое пособие

Минск БГМУ 2018

УДК 616.314–77(075.8)-054.6
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Рекомендовано Научно-методическим советом университета в качестве учебно-методического пособия 21.03.2018 г., протокол № 7

Авторы: С. А. Наумович, С. В. Ивашенко, А. А. Остапович, В. А. Шаранда, Т. В. Крушинина

Рецензенты: канд. мед. наук, доц. Н. М. Полонейчик; д-р мед. наук, проф. Т. Н. Терехова; канд. филол. наук, доц. М. Н. Петрова

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Представлены данные и иллюстрации клинико-лабораторных этапов изготовления несъёмных зубных протезов.

Предназначено для студентов медицинского факультета иностранных учащихся, обучающихся на английском языке по специальности «Стоматология».

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MOTIVATIONAL CHARACTERISTICS OF THE TOPIC

Total time of class:

– in the fifth semester — 40 h;

– in the 10th semester — 32 h;

– in the elective course — 28 h.

An artificial crown is a denture applied to a specially prepared natural or artificial tooth crown to restore its anatomical shape and function or for fixation of dentures, various prosthetic and orthodontic devices and splints. They can be used as an independent type of prosthesis or an integral part in others.

Subject of the class: to study the clinical and laboratory stages of the manufacturing of inlays, artificial crowns and fixed bridges.

Tasks of the class:

1. To study the features of the preparation of teeth for cast post and core (root inlays)

2. To study the clinical and laboratory stages of manufacturing of porcelain-fused to metal crowns and bridges.

3. To study clinical and laboratory stages of manufacturing of porcelain-fused to metal crowns with the support on dental implants.

Requirements for the initial level of knowledge

To fully master the topic, the student must repeat:

– human anatomy: anatomical structure of the teeth of the upper and lower jaws; types of bite; anatomical structure of the TMJ;

– Histology, cytology, embryology: morphological features of the structure of the teeth, bone tissue of the alveolar process of the upper and lower jaws;

– Normal physiology: functional changes in the dentition and bite with defects in hard tooth tissues and defects in the dentition;

– Materials Science: Materials and tools necessary for the manufacture of fixed dentures.

Control questions from related disciplines

1. Types of bite-occlusion, the structure of teeth and rows in the dentition.

2. Articulation, occlusion, bite.

3. Basic and auxiliary materials used for the manufacturing of fixed dentures.

Control questions on the topic of the lesson

1. Etiology, pathogenesis of defects in the dental hard tissues.

2. Etiology, pathogenesis of defects in tooth rows dentition.

3. Classification of defects of teeth hard tissues and defects in the «teeth rows» dentition.

4. Basic and additional methods of examination of patients with hard tissue defects of teeth and partial secondary edentia.

5. Treatment of patients with defects in hard teeth and partial secondary edentia with fixed dentures.

EDUCATIONAL MATERIAL
PROSTHETIC TREATMENT OF DEFECTS IN CROWNS OF TEETH WITH PORCELAIN-FUSED TO METAL CROWNS

Indications for the production of artificial crowns*:*

1) Teeth hard tissue pathology (caries, attrition, pathological abrasion, hypoplasia, fluorosis, erosion), traumatic injuries that can not be restored by filling or making inlays. With the size of the tooth crown defect within 50–80 %;

2) restoration of the lower third of face height if it decreases (abnormal tooth wear (restoration of the shape of the crown, prevention of further abrasion/attrition), pathology of the occlusion;

3) tooth shape anomalies (Hutchinson's teeth, Fournier, Pfluger, Turners teeth, spike-like teeth);

4) abnormalities of teeth position;

5) violation of the color of natural teeth (dysplasia of Capdepon-Stenton, marble disease, hypoplasia, fluorosis, pulpal death, improper treatment);

6) teeth, designed for fixing/retainment of non-removable or removable dentures (telescopic crowns);

7) convergence, divergence or over-eruption of teeth (Popov-Godon phenomenon);

8) special preparation of the tooth (for the clasp or occlusal rest);

9) Splinting in case of periodontal diseases and jaw fractures;

10) fixation of prosthetic, orthodontic or maxillofacial devices.

Contraindications to the manufacturing of the artificial crowns:

1. Relative:

– The «unsanitary» oral cavity (the presence of dental deposits, the non-filled carious cavities, non extracted destroyed teeth and roots, the crown of the destroyed teeth of more than $^1/_2$ of its height); Teeth with untreated foci of chronic inflammation in the marginal or apical periodontium (non-obturated, under-filled canals, hard-to-reach canals, cystogranulomas, cysts, fistula);

– Incomplete jaw growth and root formation;

– The severe general health condition (myocardial infarction, ischemic heart disease, acute form of hypertension).

2. Absolute:

– Intact teeth, if they are not used as abutments;

– Pathological mobility of a tooth of III degree; chronic foci of infection in the periodontal region, which could not be treated conservatively.

The main requirements for an artificial crown

The crown must:

1)restore the anatomical shape of the tooth, have a well-defined equator;

2) fit tightly to the tooth tissues in the cervical region all along;

3) create close contact with adjacent teeth (contact point) and teeth of the opposite jaw, without highspots;

4) the margin is submerged in the gingival sulcus 0.2–0.3 mm or stays at the level of the gum;

5) to restore the aesthetic norms as much as possible, corresponding to the color of natural teeth;

6) restore the function of chewing and speech;

7) do not interfere with the contacts of dentition in any occlusal phases;

8) have moderately expressed and rounded cusps on the occlusal surface of teeth that are used to chewing; do not block the movements of the lower jaw.

Clinical and laboratory stages of manufacturing of porcelain-fused to metal crowns and bridges

Clinical stage	Laboratory Stages
1. Patient examination. Diagnosis. Treatment plan. The choice of denture design.	
2. Preparation for prosthetics (making **Root inlay (Cast Post and Core)** according to indications). Preparation of abutment teeth. Manufacturing of temporary crowns.	
3. Final preparation of the stump of the tooth and the finishing lines (if necessary). Taking working (silicone) and auxiliary (alginate) impressions and occlusion recorders.	
	1. Casting working (combined sectional) and auxiliary models. Placement of models into the articulator. Manufacturing of a cast framework.
4. Verification of the design of the cast-metal-framework of porcelain-fused to metal denture. The choice of the color of the ceramic facing.	
	2. Sand blasting, the creation of an oxide film/layer on the metal framework. Sintering of ceramic facing (application of opaque, dentine and enamel layers).
5. Verification of the design of the porcelain-fused to metal denture	
	3. Glazing of porcelain-fused to metal denture.
6. Fitting and cementing the porcelain-fused to metal denture. Recommendations for care.	

Partial tooth loss (partial edentulism, partial absence of teeth, partial edentia) is one of the most common diseases: according to the World Health Organization, it affects up to 75 % of the population in various regions of the

globe. In our country, in the overall structure of medical care for patients in the treatment and prophylactic institutions of the dental profile, this disease ranges from 40 to 75 % and occurs in all age groups of patients. Partial secondary edentia directly affects the patient's quality of life.

It causes violation, up to complete loss, of the vital function of the organism — chewing food, which affects the digestive processes and the intake of necessary nutrients in the body, and also often causes the development of diseases of the gastrointestinal tract of an inflammatory nature.

No less serious are the consequences of partial secondary edentia for the social status of patients: violations of articulation and diction affect the communication abilities of the patient; they, together with changes in appearance, due to loss of teeth and developing atrophy of the masticatory muscles, can cause changes in the psychoemotional state, up to the disturbances of the psyche. Partial secondary edentia is also one of the causes of the development of specific complications in the maxillofacial area, such as the Popov-Godon phenomenon, dysfunction of the temporomandibular joints and the associated pain syndrome.

A CLINICAL EXAMPLE OF MANUFACTURING A PORCELAIN-FUSED TO METAL CROWN

The defect of the tooth crown 25 in the patient M. (fig. 1).

The patient is referred for an X-ray examination. The x-ray of the root of the tooth 2.5 is shown in figure 2.

Fig. 1. Defect in the tooth crown 2.5 in the patient M.

Fig. 2. Periapical X-ray of the tooth 25

Preparation of the root of the tooth 25 for root inlay (post-and-core) is shown in figure 3–5.

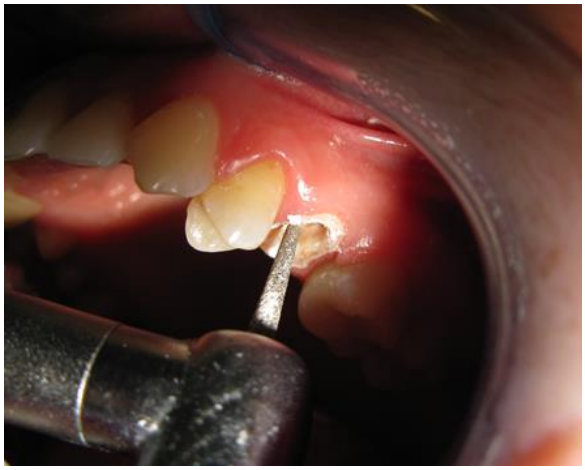

Fig. 3. Preparation of tooth stump and opening of the tooth's orifice 25.

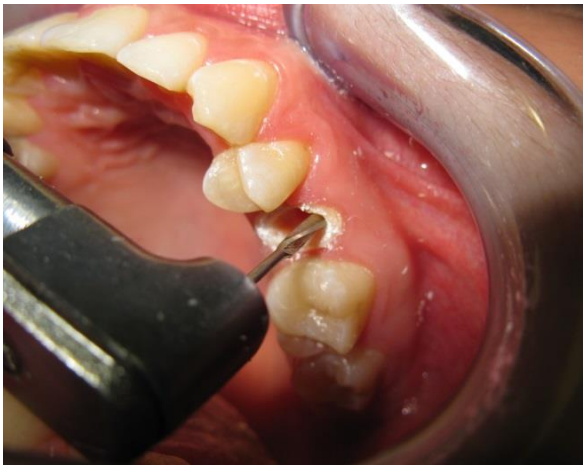

Fig. 4. Removing of gutta-percha from the root of the tooth 25 with the help of Largo-drill

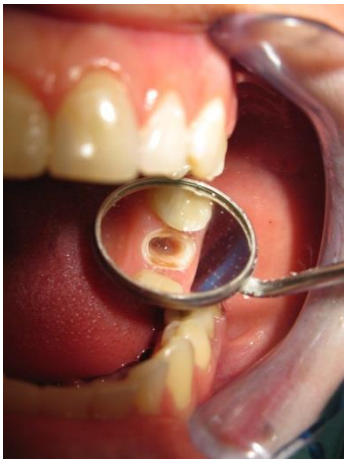

Fig. 5. Visual control using a dental mirror

Modelling of the wax pattern for the cast metal post is shown (fig. 6–10).

Fig. 6. Formation of the root part of the full metal cast core post inlay

Fig. 7. Injection of softened wax «Lavax» (pattern modelling wax) in the root canal 25

Fig. 8. Control of the wax reproduction of the post of the cast metal root inlay

Fig. 9. Formation of the «stump» (wax preproduction) of cast metal root inlay

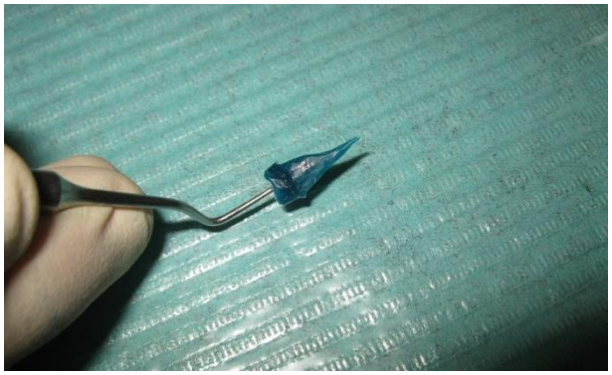

Fig. 10. Ready wax pattern of cast metal root inlay (post and core)

The replacement of wax by metal in the casting laboratory is presented on slides (fig. 11–20).

Fig. 11. Creation of a sprue system («pine tree») on the sub cone

Fig. 12. Preparation of investment material mass

Fig. 13. Forming of the flask on a vibrating table

Fig. 14. Investment is released from the sub-cone after solidification

Fig. 15. Insertion of the flask in the muffle furnace

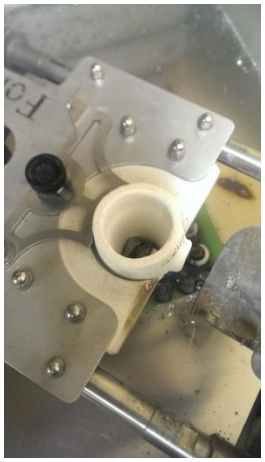

Fig. 16. Ceramic crucible for melting metal in a foundry (casting lab)

Fig. 17. Installing flasks in centrifuge casting plant

Fig. 18. Flask with metal casting inside cools in the outside air

Fig. 19. Casting, liberated and cleaned from investment material

Fig. 20. The cast metal post separated from the sprue system

After that dentist prepare, fit and fix metal post in patients mouth (fig. 21–24).

Fig. 21. Removing the sprue and pre-processing the cast metal post inlay

Fig. 22. Antiseptic treatment of the metal cast past inlay before inlay checking in the mouth

Fig. 23. Checking the shape of the cast metal post and core

Fig. 24. Cementing the cast metal post with glass ionomer cement

Then, after cement became hard, dentist prepare tooth under crown (fig. 25–27).

Fig. 25. Preperation of the root with cast metal post and core of the tooth 2.5, forming the bevel finishing line

Fig. 26. Preperation of the occlusal tooth surface of 2.5

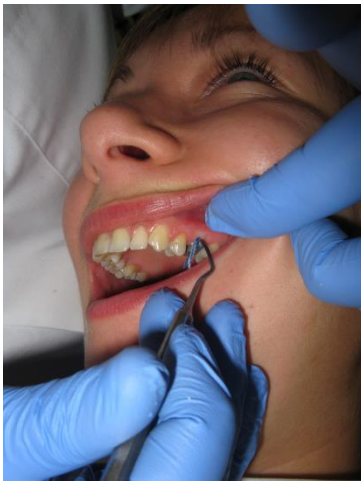

Fig. 27. Packing of the retraction cord into the dentogingival sulcus

Taking a two-layer silicone impression is shown in figures 28–39.

Fig. 28. Preparation of putty impression material for the base layer of the impression.

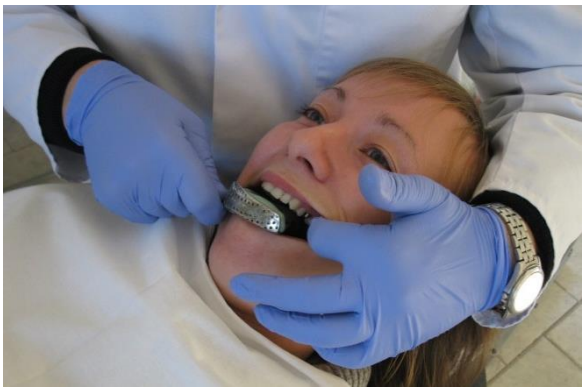

Fig. 29. Insertion of an impression tray with impression material into the oral cavity

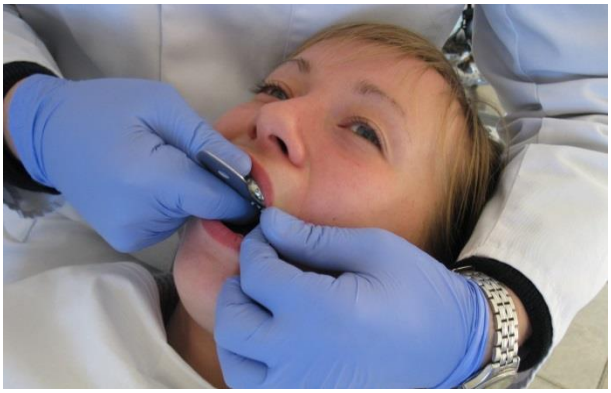

Fig. 30. Positioning and sitting the impression tray on the upper teeth

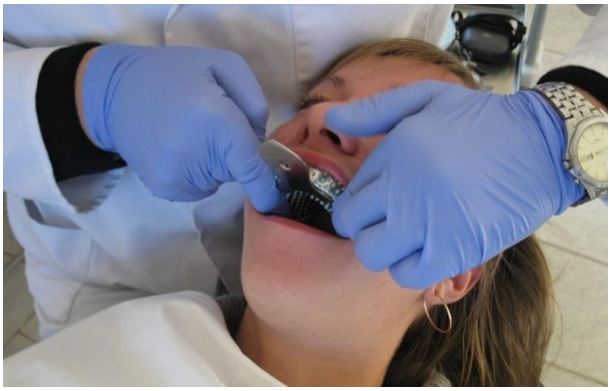

Fig. 31. Forming the margins of the impression and securing the tray with the impression material in the oral cavity

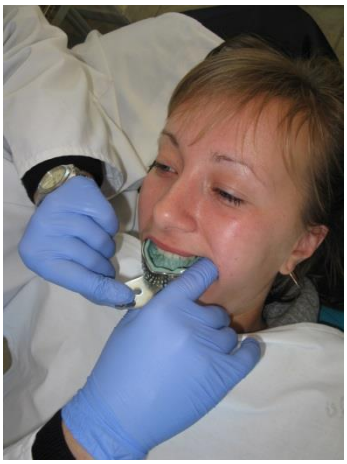

Fig. 32. Removal of impression tray

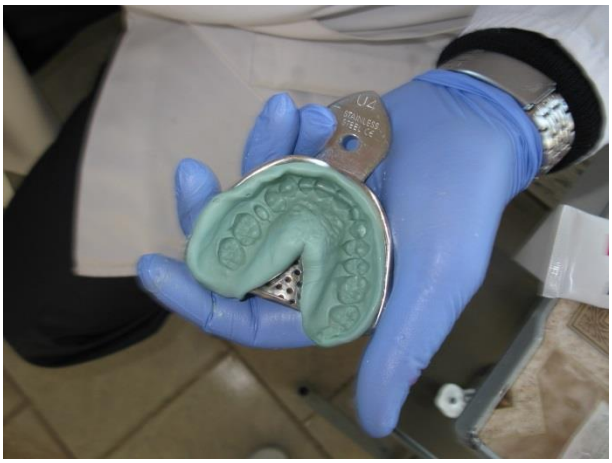

Fig. 33. Evaluation of the impression

Fig. 34. Creation of diverting grooves for light-body mass (wash layer)

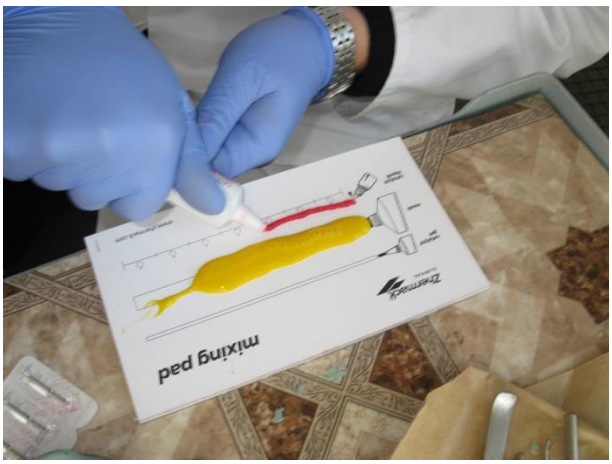

Fig. 35. Preparation of light body mass

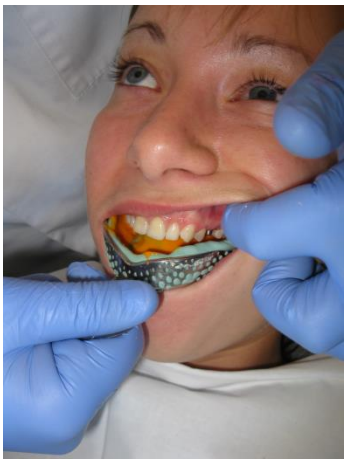

Fig. 36. Taking the wash impression

Fig. 37. Evaluation of the wash impression

Fig. 38. Fixation of central occlusion with silicone bite registrators

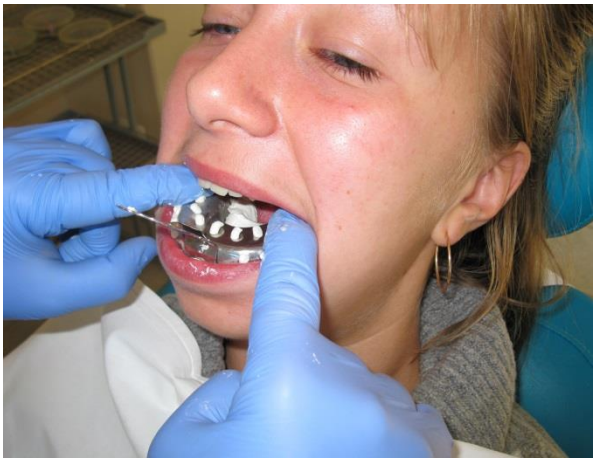

Fig. 39. Taking the auxiliary impression

The preparation of the provisional crown is presented in figures 40–43.

Fig. 40. Making a provisional crown by the method of free molding

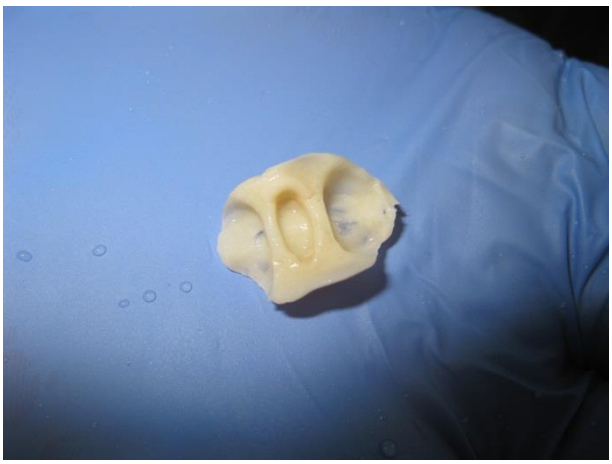

Fig. 41. Hardened via cold polymerization acrylic plastic.

Fig. 42. Removal of the surplus plastic and the shaping of provisional crown

Fig. 43. Fitting in and temporary cementing of the provisional crown

Laboratory stages are presented on figures 44–47.

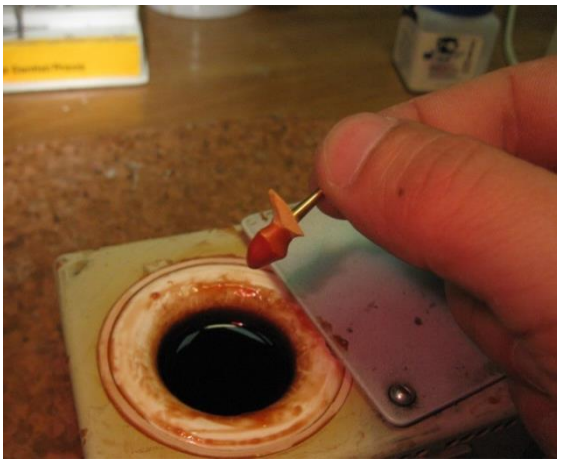

Fig. 44. Making a wax cap (pattern)

Fig. 45. Sandblasting of a cast cap

Fig. 46. Metal cap with an oxide film

Fig. 47. Sintering of layers of ceramic mass (opaque, dentin, enamel layers)

Metalceremic crown dentist control in mouth cavity, and correct it (fig. 48, 49). After that technition glaze the crown (fig. 50).

Fig. 48. Checking the porcelain-fused to metal crown in the oral cavity. Control of occlusal contacts

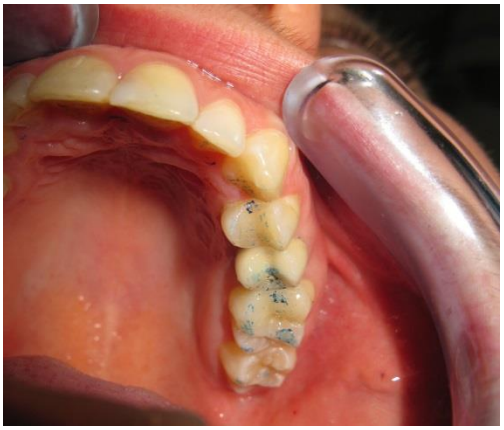

Fig. 49. Uniform occlusal contacts

Fig. 50. Glazed porcelain-fused to metal crown

Fixation of the porcelain-fused to metal crown of the tooth 25 is shown in figures 51–55.

Fig. 51. Insulation from oral fluid

Fig. 52. Degreasing the cast metal post and core of the tooth 2.5 followed by drying it before fixing the crown

Fig. 53. Insertion of the fixation material (dental cement) in the crown

Fig. 54. Positioning and sitting the crown on the tooth stump 2.5

Fig. 55. Fixed porcelain-fused-to-metal crown on tooth 25

A CLINICAL EXAMPLE OF MANUFACTURING A PORCELAIN-FUSED TO METAL BRIDGE.

Patient B., 40 years old, was admitted the continuation of treatment. The teeth 23, 25 are restored with metal cast post and core (root inlay) constructions. In the area of the tooth 22, an implant fixture with a healing abutment was installed (fig. 56). The result of the X-ray examination is shown (fig. 57).

Fig. 56. Clinical Case of Patient B.

Fig. 57. Panoramic X-ray of patient B.

Diagnosis: partial secondary edentia of the upper jaw, 3rd class by Kennedy, teeth 23, 25 crown defects (fig. 56).

Treatment plan: making a porcelain fused to metal bridge with abutment teeth 23, 25 and a porcelain-fused to metal crown supported by the implant in the area of the missing tooth 22.

The patient teeth 23, 25 were prepared and a provisional bridge denture was made.

In the next visit, the provisional denture was removed and the teeth 23, 25 were additionally prepared, a retraction cord was packed in sulcus, and the impressions were taken for the manufacture of the PFM bridge denture, the shade of the ceramics was determined (fig. 58–62).

Fig. 58. Final preparation of teeth 23, 25 as abutments of PFM bridge

Fig. 59. Packing the retraction cord into the dentogingival sulcus

Fig. 60. Taking impressions

Fig. 61. The working and auxiliary impressions and bite registrators taken

Fig. 62. The determination of the shade of the ceramic lining (done by the dentist, dental technician and the patient together if possible)

The impressions were transferred to the dental laboratory for the production of a cast metal framework of the bridge (fig. 63–79).

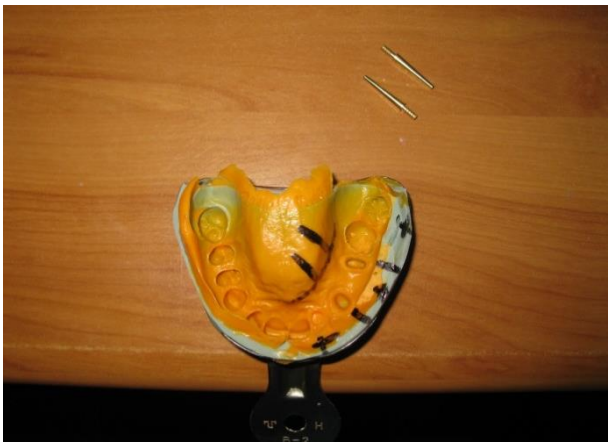

Fig. 63. Marking of the working impression for the insertion of pins before casting a combination sectional model

Fig. 64. Model casting from dental rock on vibration table

Fig. 65. Insertion of pins and creation of retention points for reliable connection of dental rock with plaster of the model base

Fig. 66. Coating of dental rock after set with vaseline oil in the area of pins (tail-ends)

Fig. 67. Manufacture of the base of combination sectional model from plaster

Fig. 68. Ready-made combination sectional model

Fig. 69. Making sectional cuts

Fig. 70. Removed dies

Fig. 71. Preparing dental rock die contours

Fig. 72. Ready-made combination sectional model

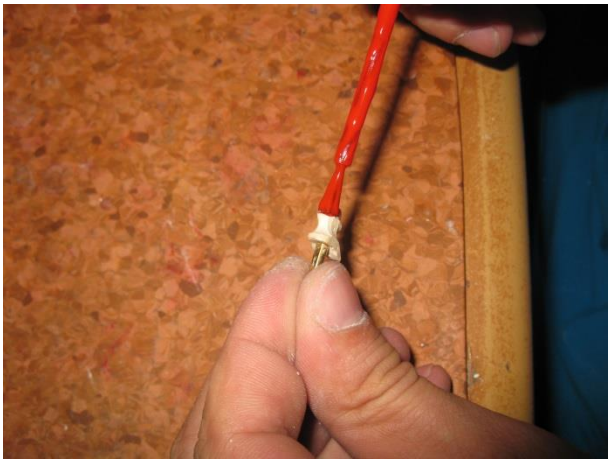

Fig. 73. Application of compensating lacquer

Fig. 74. Prepared dies

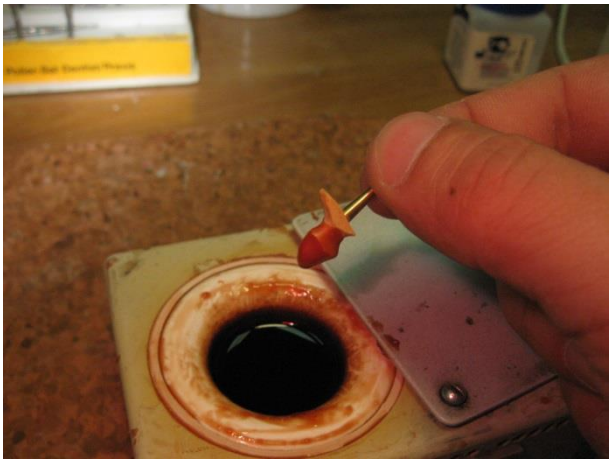

Fig. 75. Making a wax cap

Fig. 76. Wax pattern of the framework modeled

Fig. 77. Cast metal framework adjusted on the model

Fig. 78. The framework of the bridge, covered with opaque porcelain layer

Fig. 79. Framework with ceramics sintered

Fig. 80. Cemented ready-made PFM denture in the oral cavity

The design of the PFM bridge was verified (on the model and in the oral cavity of the patient), glazed and cemented on abutment teeth (fig. 80).

DENTURES OF PATIENTS WITH DEFECTS OF THE DENTITION WITH THE DENTAL IMPLANT SUPPORT

After cementing the porcelain fused to metal denture, we started making a crown on tooth 2.2 for the implant abutment. We took a preliminary impression from the upper jaw and an individual impression tray was made. After we took the putty layer of the silicone working impression, an opening in the impression material and the tray was cut for implant transfer. After this, the healing cap was removed, the impression transfer was attached to the implant with a screw and the impression was taken for the manufacture of artificial crown on the implant. The porcelain-fused to metal crown was made according to the procedure described above (fig. 81–104).

Fig. 81. Making of individual tray with holes for retention of the impression material

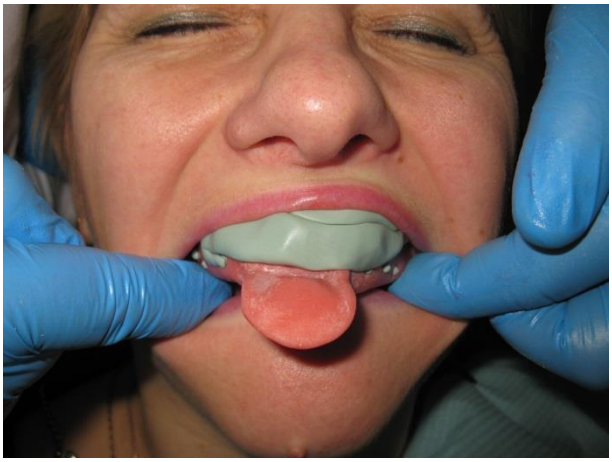

Fig. 82. Taking the putty layer of the impression with silicone type 1

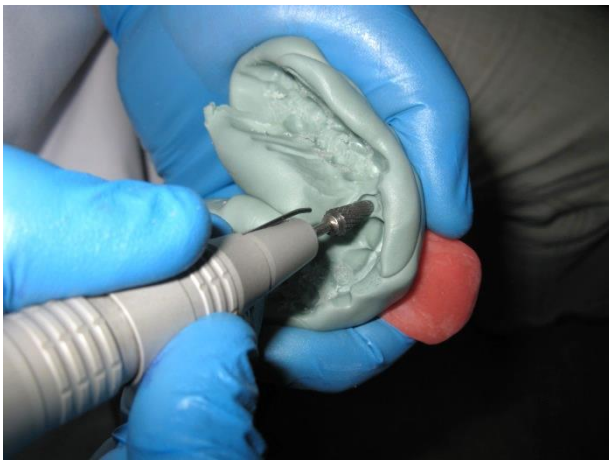

Fig. 83. Creating a hole for the transfer

Fig. 84. Hole for transfer in the silicone impression

Fig. 85. Unscrewing of the healing cap with a torque wrench

Fig. 86. Removing the healing cap with a screwdriver

Fig. 87. The transfer attached

Fig. 88. The wash impression material syringed around the transfer

Fig. 89. Taking the wash impression (note the screw top coming out of material)

Fig. 90. Removing the screw securing the transfer

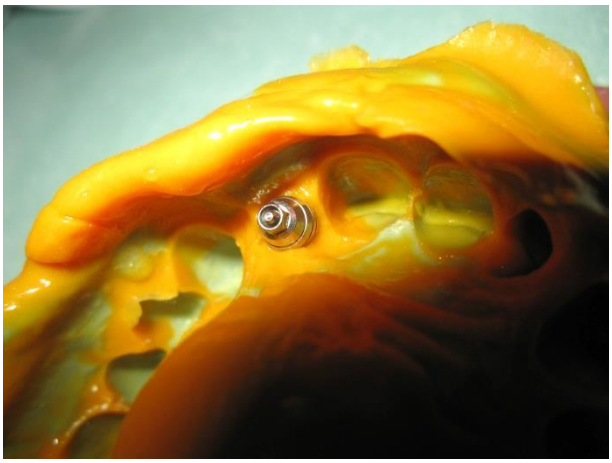

Fig. 91. Impression taken with transfer

Fig. 92. The implant analog set in the impression

Fig. 93. The working model cast with transfer and artificial gum around the implant analogue

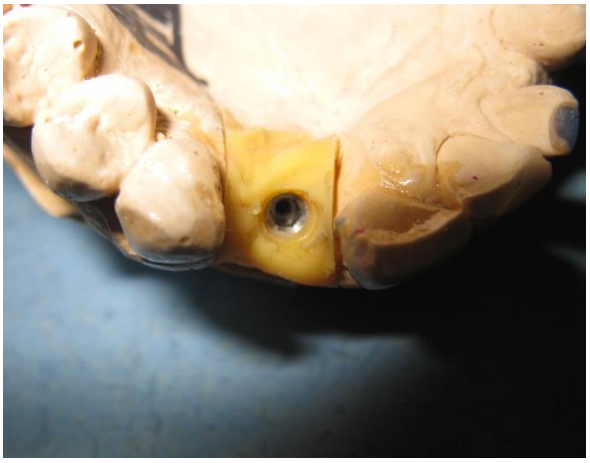

Fig. 94. Transfer removed from the model

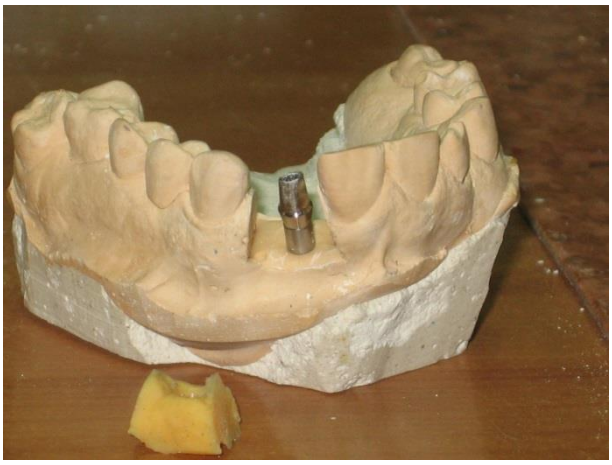

Fig. 95. Model with abutment prepared for milling

a ***b***

Fig. 96. a — abutment on the model; *b* — view of abutment with the screw

Fig. 97. Manufactured crown of tooth 22 on the implant abutment on the model

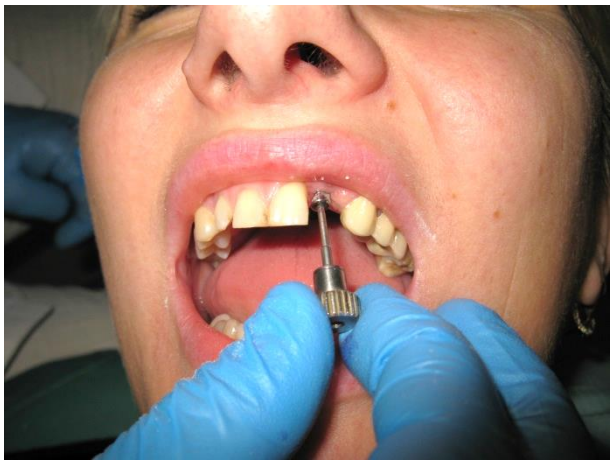

Fig. 98. Removng of the healing cap

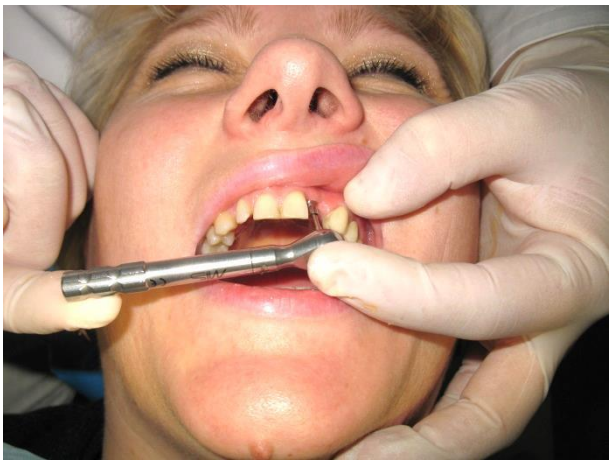

Fig. 99. Installing the abutment

Fig. 100. Attaching of the screw with torque wrench

Fig. 101. The abutment installed

Fig. 102. The fixing screw hole is covered with silicone

a ***b***

Fig. 103. Crown on the implant in the oral cavity:
a — is the right view; *b* — is the left

Fig. 104. Cementing of porcelain-fused to metal crown after glazing

TASKS FOR SELF-CONTROL

1. The most common cause of defects in hard tissues of teeth is:

a) Abfraction defects;
b) Hypoplasia;
c) Caries;
d) Abrasion.

2. When preparing the teeth for stamped crowns which instruments are not used:

a) Vulcanite discs;
b) Carborundum grinding wheels;
c) Diamond separation discs;
d) Diamond grinding wheels.

3. Tools used for fitting and shaping crowns:

a) Carbide burs;
b) Stainless steel burs;
c) Diamond burs;
d) Vulcanite elastic disk.

4. The sectional model, in the manufacturing of cast bridges is made for the purpose of:

a) Precision casting;

b) Duplicating a model from refractory material;

c) Convenience of modeling the framework of the future bridge;

d) Prevention of the shrinkage of the metal.

5. The incorrect requirement for post constructions:

a) Fixates well in the root via properties of the post;

b) Do not interfere with the movements of the lower jaw and satisfies the aesthetic requirements;

c) Tightly adapted to the root surface;

d) Thickness of the post 0,2–0,3 mm.

6. A simple post tooth includes:

a) post soldered to the cap;

b) post with inlay;

c) Wire post with plastic crown;

d) post with protection cover.

7. Root canal treatment of abutment teeth in the manufacturing of stamped-welded bridge denture is not necessary in case:

a) significant tilting of supporting teeth;

b) At the expressed atrophy of osseous tissue in the location of the retaining tooth;

c) With a pronounced dentoalveolar elongation;

d) With the parallelism of supporting teeth.

8. In what direction should the excess of cement be scaled after fixing the stamped crown:

a) From the gingiva to the occlusal surface;

b) From the occlusal surface to the gum;

c) From the distal to the medial surface;

d) From the medial surface to the distal.

9. To reveal highspots for fitting the PFM and MA dentures we use:

a) Articulation paper;

b) Chemical pencil;

c) Zinkoxide-eugenol paste;

d) Powder of gypsum.

10. The accuracy of the fit of the crowns to the teeth, with the fitting of cast, PFM and MA bridges are evaluated by:

a) Gypsum;

b) Articulation paper;

c) Elastic impression material;

d) Water dentine.

11. The root canal should be sealed:

a) up to the apical opening;

b) not reaching 0.5 mm before apex;

c) not exceeding 1 mm before apex;

d) not exceeding 0.3 mm before apex.

12. Indicate what determines the subclass of defects in the Kennedy dentition:

a) The length of the defect;

b) Defect topography;

c) The total number of all defects of the dentition;

d) The number of dentition defects that do not determine the defect class.

13. Abutment teeth are prepared without finishing line when manufacturing such a bridge construction:

a) Plastic;

b) Metal ceramic;

c) Metal-acrylic;

d) Stamped-soldered.

LITERATURE

1. *Nallaswamy, D.* Textbook of Prosthodontics : Textbook / D. Nallaswamy, K. Ramalingom, V. Bhat. Jaypee Brothers, Medical Publishers. 2004/ 842 p.

2. *Stephen, F.* Contemporary Fixed Prosthodontics, Fourth edition : Textbook / Stephen F. Rosenstiel, Martin F. Land, Junhei Fujimoto, Elsevier Inc. 2010/ 940 p.

3. *Fundamentals* of Fixed Prosthodontics / Herbert T. Shillingburg [et al.]. Quintessence Publishing. 2008. 574 p.

4. *Prosthodontic* Treatment for Edentulous Patients / George Zarb [et al.]. Elsevier. 2014. 466.

5. *Полонейчик, Н. М.* Оттискные материалы = Impression materials : учеб.-метод. пособие / Н. М. Полонейчик, К. И. Чистик. Минск : БГМУ, 2017. 39 с.

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